Broad-toothed Rat *Mastacomys fuscus* distribution in Buccleuch, Bago and Maragle State Forests, NSW

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ABSTRACT

Buccleuch, Bago and Maragle State Forests were surveyed for the broad-toothed rat *Mastacomys fuscus* as part of a strategic survey program for threatened species. Wetlands were surveyed for broad-toothed rats during summer-autumn 2003 and summer-autumn 2004. Broad-toothed rats were recorded from 15 of the 50 sites surveyed in Buccleuch, 9 of 34 sites in Bago and eight of eight sites surveyed in Maragle. Grazing, particularly by feral horses, appeared to be a major factor in the absence of broad-toothed rats from a number of sites. Drainage of large sites, with the associated changes in vegetation was also recorded from several sites.

Key words: Broad-toothed rat, *Mastacomys fuscus,* habitat, threats.

Introduction

The broad-toothed rat *Mastacomys fuscus* is an endemic monotypic species, with a restricted and disjunct distribution from Tasmania to Barrington Tops in NSW (Watts & Aslin 1981; Happold 1995; Menkhorst 1995). The species is classified as 'Lower risk - near threatened' in Victoria (Dept Natural Resources and Environment 2000) and 'Vulnerable' in NSW (*Threatened Species Conservation Act 1995*). Major threats are believed to include habitat destruction/modification, fox *Vulpes vulpes* predation and global warming (Brereton *et al.* 1995; Green and Osborne 2003). Green and Osborne (2003) found that rabbits *Oryctolagus cuniculus* and hard-hoofed herbivores were responsible for damaging native vegetation and opening up inter-tussock areas where *M. fuscus* normally construct its runways, resulting in the absence of the species from sites previously occupied.

The fossil record suggests that the species had a much broader, continuous distribution throughout south-eastern Australia, until the late Pleistocene (Watts and Aslin 1981). Current distribution is centred on alpine and subalpine heathlands and open woodlands in the Snowy Mountains in NSW and the Victorian Alps, wet sclerophyll forests in the Otways and Dandenong Ranges in Victoria and in wet sedgelands and subalpine heathlands in Tasmania (Watts and Aslin 1981; Happold 1995; Menkhorst 1995).

The Broad-toothed rat is generally restricted to areas with rainfall greater than 1000 mm, with a dense ground cover of grasses, sedges, herbs and shrubs, from sea-level to 2200 m (Happold 1995; Menkhorst 1995). The species is strictly herbivorous, feeding primarily on grasses, leaves and seeds (Carron *et al.*1990).

M. fuscus is a seasonal breeder. Mating begins in October and most births occur between late October and November in alpine areas (Happold 1989). Bubela *et al.* (1991) found that male *M. fuscus* home range size was significantly greater than female home range size in January but not significantly different in late summer-autumn. Bubela and Happold (1993) reported that female *M. fuscus* is territorial in summer, while male home ranges overlap with other males and up to three females. The species is solitary during the breeding season, but males and females are recorded together in communal nests during winter (Belcher 1998; Bubela *et al.* 1991).

Green and Osborne (2003) surveyed the known range of *M. fuscus* in New South Wales between 1999 and 2001 and recorded the species from two sites in Buccleuch State Forest (SF). The present study surveyed for *M. fuscus* as part of a strategic survey for threatened species within State Forests, at a finer scale than the survey conducted by Green and Osborne (2003). The present survey also described habitat at the sites where *M. fuscus* was recorded and attempted to identify threats to the species.

Methods

Study Area

Bago (31,800ha), Maragle (12,200ha) and Buccluech (17,900ha) State Forests occur in a narrow tract of the South-eastern Highland Biogeographic Region bounded by the Australian Alps and South Western Slopes bioregions to the east and west. Elevations range from 400 metres to 1440 metres. Rainfall is strongly associated with elevation, with an increase of approximately 250 mm for every 300 m rise from the south western slopes towards the Alps (Anon 1977). As most rainfall occurs in winter and spring, extended dry periods often occur during summer and autumn but extreme summer droughts are rare (rainfall records, State Forests of NSW records, Tumut and Tumbarumba).

The vegetation mainly consists of subalpine forests of relatively simple composition. At lower altitudes (600–1000 m), wet sclerophyll associations mainly consist of Robertson's Peppermint *Eucalyptus robertsonii* and Mountain Gum *E. dalrympleana*/Manna Gum *E. viminalis*. Alpine Ash *E. delegatensis* becomes increasingly dominant at higher elevations, reaching its optimum development between altitudes of 1100 m and 1300 m on deep, well-drained granite soils. Pure stands of Snow Gum *E. pauciflora* occur as alpine woodlands above 1420 m, and Black Sallee *E. stellulata* commonly occurs on poorly drained, frost prone areas.

Open treeless areas form a distinctive landscape feature in low-lying depressions and frost hollows with impeded drainage. The vegetation ranges from wet tussock grasslands and sub-alpine healthland at lower elevations, to *Sphagnum* herb-fields at higher altitudes.

Survey Technique

Wetlands in the Buccleuch, Bago and Maragle State Forests were identified and mapped from aerial photographs. To determine the recent presence of M. *fuscus,* wetlands were surveyed for the presence of scats (following Happold 1989 and Wallis 1992) between December 2002 and March 2003 at Buccleuch SF and between December 2003 and April 2004 in Bago and Maragle SFs. Scats from M. *fuscus* are readily distinguishable from other sympatric species as they are green when fresh, fading to a pale green to straw colour over time (Happold 1989). Search time at each site varied from 10 minutes up to about three hours, depending on the size and extent of habitat and how quickly scats were found. Searching continued until at least three scats were found or the entire wetland searched. The forest type, altitude, presence of suitable vegetation, dominant cover species and presence of runways was recorded at each site. Other factors such as evidence and intensity of grazing from direct observation, presence of scats or hoof prints and drainage were also recorded. Grazing was classified as heavy when the vegetation was trampled or grazed to a height that precluded cover for runways or the inter-tussock distance was increased to the extent that cover was absent between tussocks. The herbivores responsible for grazing were identified by sight and from the presence of scats in the wetlands. A Chi-square test of a 2 x 2 contingency table using Yates correction was used to determine the significance of grazing on the presence of M. *fuscus* in floristically suitable habitat. Suitable habitat comprised sedges, grasses, sphagnum, rushes and heath species such as *Baeckea gunniana* and *Leptospermum spp.*

Results

Buccleuch State Forest

Scats of M. *fuscus* were found at 15 of 50 (30%) sites surveyed in four broad vegetation types in Buccleuch SF (Fig. 1,Table 1.). A further seven sites, where no scats were found, had runways typical of those used by the species. The majority of M. *fuscus* records (11 of 15) were recorded from wetlands with snow gum *Eucalyptus pauciflora* and/or *E. stellulata* forest types, indicating that the wetlands were in cold air drainage areas. Two sites were in wetlands in mixed species forest, one in pine, which presumably was mixed species prior to clearing and two in the large Micalong swamp complex. Thirteen of the 15 sites had a shrubby or heathy overstorey of species such as *Leptospermum spp, Baeckea gunniana* and/or *Rubus rubicundus*. The other two sites were in the large Micalong swamp complex, which was dominated by sedges and grasses. M. *fuscus* were recorded at altitudes between 1000 – 1160 m (Fig. 1).

Bago State Forest

Broad-toothed rat scats were found at 9 of the 34 (26.5%) sites surveyed (Fig. 1, Table 1). Runways were found at a further three sites. Eight of the nine sites had a heath component of *Baeckea gunniana* and usually contained sphagnum, sedge and grasses. One site had blackberry, sedge and grasses. Snow gum and or black sallee were commonly associated with the wetlands, which occurred within mixed species forest. Broad-toothed Rat scats were recorded at altitudes of between 1090 – 1232 m.

Maragle S. F.

Broad-toothed Rat scats were found at the eight sites surveyed (Table 1). Seven of the eight sites had heath species present including *Baeckea, Hakea* and *Leptospermum* species and a combination of sedges, grasses and rushes. One site contained blackberries, grasses and sedges. All sites were between 1029 and 1109 m ASL, in mixed species forests.

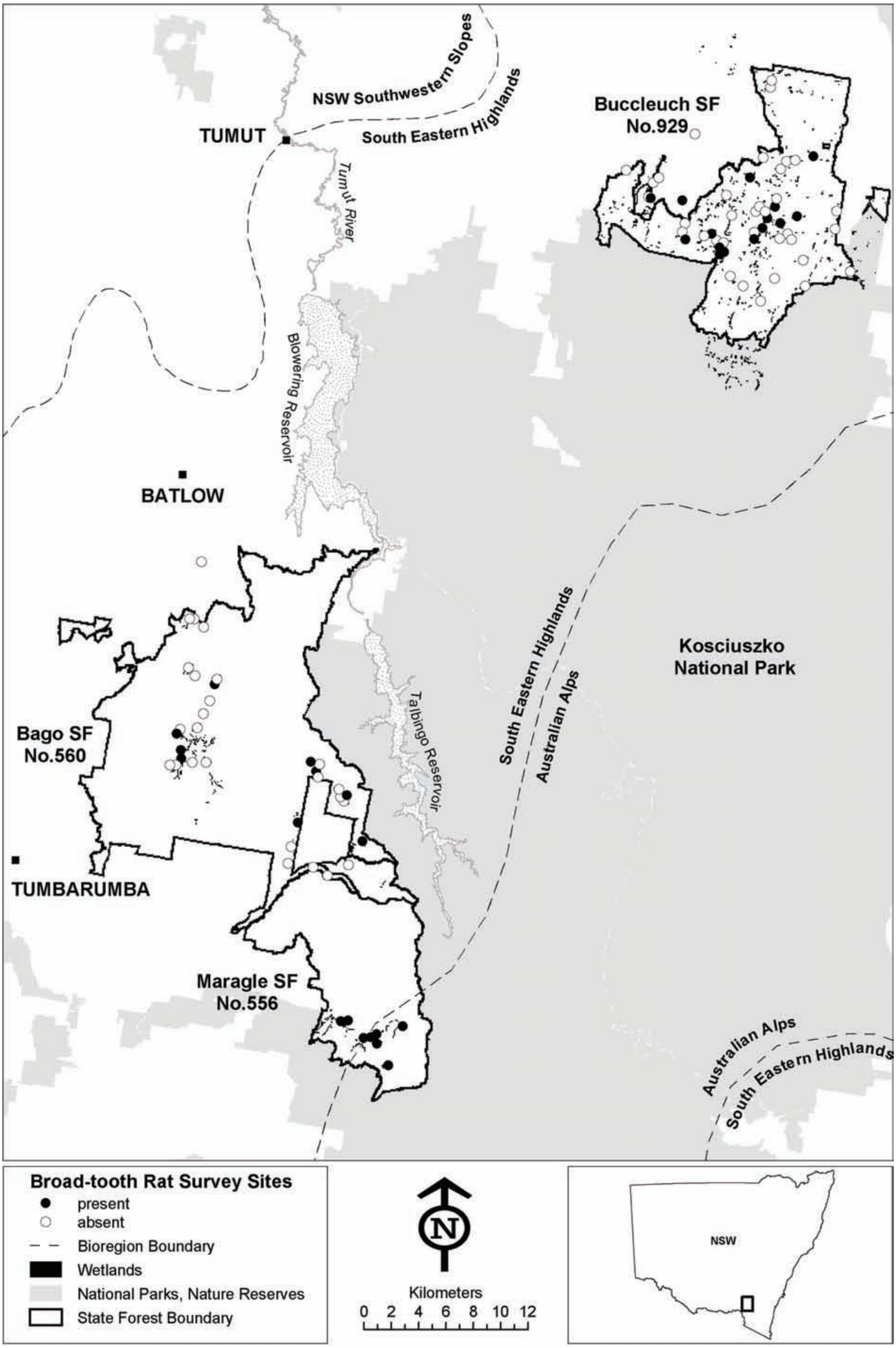
Heavy grazing and trampling of floristically suitable habitat, principally by feral horses *Equus caballus*, but also by cattle *Bos taurus*, rabbits and pigs *Sus scrofa* was recorded at 16 sites in Buccleuch S. F. and 20 sites in Bago and Maragle S. Fs. Grazing and trampling by horses was recorded at 81%, and by cattle at 25% of the heavily grazed sites in Buccleuch SF. In Bago and Maragle S.Fs., horses were recorded at 95% and cattle at 65% of the heavily grazed sites. Three sites, one each in Buccleuch, Bago and Maragle S.F. had the centre heavily grazed, but broad-toothed rat scats were present in the ungrazed or lightly grazed margins. Grazing resulted in shortening of grass, sedge and rush cover, an increase in inter-tussock distances and physical damage resulting in flattening of the available cover.

The Chi-square test found a highly significant association between the variables, in particular the presence of M. *fuscus* scats is associated with ungrazed/lighly grazed sites containing floristically suitable species (Table 2).

Evidence of drainage was found at three large wetlands in Buccleuch S. F., resulting in a change in the composition of the vegetation, with *Poa labillardieri* becoming dominant at the expense of other grasses, sedges and rushes.

Discussion

The results of this study confirm the presence of M. *fuscus* at a number of sites throughout Buccleuch, Bago and Maragle State Forest. All sites were above 1000 m and predominantly in open wetlands often associated with snow gum forest types in cold air drainage areas. Many of the


NSW Southwestern Slopes
South Eastern Highlands
TUMUT
Tumut River
Buccleuch SF
No.929
Blowering Reservoir
BATLOW
Kosciuszko
National Park
South Eastern Highlands
Australian Alps
Talbingo Reservoir
Bago SF
No.560
TUMBARUMBA
Maragle SF
No.556
Australian Alps
South Eastern Highlands
Broad-tooth Rat Survey Sites
present
absent
Bioregion Boundary
Wetlands
National Parks, Nature Reserves
State Forest Boundary
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Kilometers
0 2 4 6 8 10 12
NSW

Figure 1. Study sites and survey results for *Mastacomys fuscus* in Buccleuch, Bago and Maragle State Forests, NSW between 2002 - 2003.

Table 1. Broad-toothed rat survey results from Buccleuch State Forest, NSW, between December 2002 and March 2003 and Bago and Maragle S.F.s between December 2003 and March 2004.

Site	No. sites suitable floristics	No. sites ungrazed/lightly grazed with BTR scats	No. sites heavily grazed, no scats	No. sites suitable habitat, no scats
Buccleuch	37	15	16	6
Bago	31	9	20	2
Maragle	8	8	0	0

Table 2. χ^2 contingency table for presence/absence of broad-toothed rat scats in ungrazed/lightly grazed and heavily grazed sites in Buccleuch, Bago and Maragle State Forests, NSW.

	BTR Scats present	BTR Scats absent
Heavily Grazed	O = 3 E= 15.16 χ^2 = 8.97	O = 33 E = 20.84 χ^2 = 6.52
Lightly grazed/ ungrazed	O = 29 E = 16.84 χ^2 = 8.07	O = 11 E = 23.16 χ^2 = 5.87

Highly significant at P = 0.01 level with 1 degree of freedom

sites had an overstorey of *Leptospermum sp.* and/or *Baeckea gunniana*, which appeared to provide some protection against grazing by large herbivores. The only sites where *M. fuscus* was recorded, without an overstorey, were sites in Micalong Swamp, an extensive wetland with dense stands of sedges and grasses. *M. fuscus* were not found in wetlands containing Blackwood *Acacia melanoxylon* or very dense stands of *Leptospermum*, where the densities of grasses and sedges were limited by the density of the overstorey.

The impact of grazing by cattle and feral horses on alpine and subalpine environments is well known. Research has shown that livestock grazing and associated burning practices are detrimental to soils and vegetation in the Victorian and New South Wales Alps (Byles 1932; Costin 1954; Bryant 1976; Anon 1977; Alpine Planning Project Team 1989). The two major impacts are an increase in the abundance of bare ground, with subsequent accelerated soil erosion and siltation of streams, and the modification of the structure and composition of the vegetation (Prober and Thiele 2002).

Feral horses have been identified as a threat to montane environments in many studies. Costin (1954) noted that, although the overall grazing intensity of feral horses was low, their marked preference for certain plants of the moister grasslands and bogs in the montane, subalpine and alpine tracts of the Australian Alps resulted in locally severe damage to some pedobiomes. Feral horses show preference for riparian habitats where they feed primarily on grasses, sedges and rushes (Berger 1986; Duncan 1992; Crane *et al.* 1997), placing them in direct competition with *M. fuscus* (Green and Osborne 2003; this survey).

Grazing, predominantly by feral horses, but also by cattle and rabbits appears to be the greatest threat to the continued existence of *M. fuscus* in Buccleuch, Bago and Maragle S.F.s. Grazing shortens and opens up the vegetation, removing cover and the food resource, rendering the habitat unsuitable for *M. fuscus*. Trampling by the larger herbivores, principally feral horses and cattle also damaged the vegetation. Other studies have found the species to be dependent on cover for insulation during winter and protection against predation (Green and Osborne 2003). Drainage of wetlands had also altered the vegetation composition resulting in *Poa spp.* dominated grasslands with larger inter-tussock distances resulting in open areas between tussocks.

The presence of *M. fuscus* in a number of fox scats (State Forests of NSW pre-logging survey records) suggests that fox control in areas where *M. fuscus* have been recorded may be warranted. Green (2003) found that foxes selectively preyed on *M. fuscus* relative to the Bush Rat *Rattus fuscipes*, at both alpine and subalpine altitudes in the Snowy Mountains.

The results of this survey suggest that despite being widespread, the long-term survival of *M. fuscus* in Buccleuch, Bago and Maragle State Forests is dependent upon the control of introduced herbivores, particularly feral horses and by excluding cattle grazing in wetlands.

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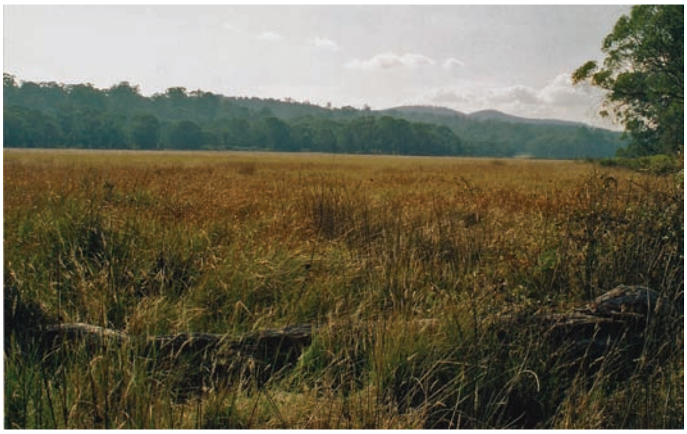
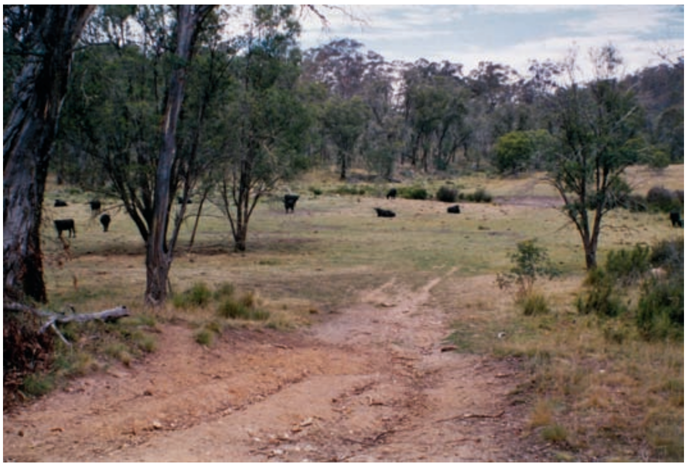
APPENDIX I



Dense sedge and grass stands in Micalong swamp.

Photo, C. Belcher.



Drained wetland with grazing cattle present. Bago State Forest.

Photo, C. Belcher.